

## Remarks

### **Rejection of claims 1-8, 14-19, and 25 are rejected under 35 USC 102(e)**

Claims 1-8, 14-19 and 25 are rejected under 35 USC 102(e) as being anticipated by Popovich (US 6,339,486).

Section 102 of Title 35 provides the novelty requirements for patentability. In order for a prior art reference to anticipate a claim it must teach each and every element of that claim. M.P.E.P. §2131. The Court of Appeals for the Federal Circuit states: "[a] claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." Verdegaal Bros. v. Union Oil Co. of California, 814 F.2d 628 (CAFC, 1987).

The Examiner states that Popovich discloses a method of fabricating an electro-optic device, comprising the steps of (i) providing a nematic liquid crystal; (ii) providing a photo-curable pre-polymer mixture; (iii) mixing said nematic liquid crystal with said photo-curable pre-polymer mixture to form a homogenous nematic/pre-polymer mixture, *with said nematic liquid crystal being greater than 40% (by weight) of said combined homogenous mixture;... [italics added, step identifiers, "(ii)", added]* (*Office Action*, dated 11/20/2002, pp 2-3.)

The present invention claims a method of fabricating an electro-optic device, comprising the steps of (i) providing a nematic liquid crystal; (ii) providing a photo-curable prep-polymer mixture; (iii) mixing said nematic liquid crystal with said photo-curable pre-polymer mixture to form a homogenous nematic/pre-polymer mixture, *with said nematic liquid crystal being greater than 40% (by weight) of said combined homogenous mixture; ... [italics added]* (Excerpted from claims 1 and 14 of the instant invention).

When one compares the excerpt of claim 1 and 14 from Applicant's invention with the Examiner's characterization of Popovich, it appears that the passages are very

similar. However, there is a significant difference between the instant invention as claimed and the Popovich disclosure. The Examiner states that Popovich discloses, in item (iii), that the homogenous nematic ... mixture, with said nematic liquid crystal being greater than 40% (by weight). There is no support for this contention in the Popovich disclosure. In fact, column 6, lines 40-47 of '486 makes it quite evident that the nematic liquid crystal never goes beyond 35%. This is a significant difference between Applicant's claimed invention that claims greater than 40% and Popovich's disclosure, never going beyond 35%.

Moreover, the nematic concentration of the instant invention is around 1.9 times greater than Popovich's, also, the PDLC birefringence in the claimed invention is about 6 times greater than that disclosed in Popovich. The reason for this significant difference in birefringence is due to the high degree of nematic orientational order in the PDLCs of the present invention, in fact, this is specifically recited in claim 13 of the present application.

Clearly, the each and every element rule articulated above has not been satisfied by Popovich and therefore, this reference fails to defeat novelty of the present invention. Independent claims 1 and 14 are novel in light of Popovich, and it is axiomatic in patent law that if an independent claim is patentable, then claims depending therefrom are also patentable. Therefore, Applicant respectfully requests reconsideration and withdrawal of the present rejection.

Furthermore, even if the Examiner relies upon a 35 USC 103 rejection of claims 1-8, 14-19 and 25, such a rejection based upon obviousness is still lacking, especially with respect to the concentration of nematic liquid crystal being greater than 40%. There is no teaching in Popovich that such a percentage is acceptable. In fact, the Popovich patent teaches away from the concentration of nematic liquid crystal being greater than 40%.

**Rejection of claims 9-13 and 20-24 under 35 USC 103(a)**

Claims 9-13 and 20-24 are rejected under 35 USC 103(a) as being unpatentable over Popovich in view of Sumiyoshi et al. (US 6,278,506).

In order to establish a *prima facie* case of obviousness, "there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references) must teach or suggest all of the claim limitations." M.P.E.P. §2143, see also, *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

A *prima facie* case of obviousness is not established in the present case as the applied references do not teach nor suggest that which is claimed by the Applicant in the present invention. The deficiencies present in Popovich are not rectified in Sumiyoshi et al. ('506).

In addition to Popovich's nematic concentration being outside the range claimed by Applicant (recall, Popovich discloses a concentration up to 35% and Applicant claims in the present invention a concentration of greater than 40%), other deficiencies exist as well. For example, Example 3 of the present application discloses a 67% nematic concentration and birefringence of 0.048. As alluded to earlier, the nematic concentration of the instant invention is around 1.9 times greater than Popovich's, also, the PDLC birefringence in the claimed invention is about 6 times greater than that disclosed in Popovich. The reason for this significant difference in birefringence is due to the high degree of nematic orientational order in the PDLCs of the present invention, in fact, this is specifically recited in claim 13 of the present application.

Additionally, Popovich describes a nematic LC monomer that is cured when UV light is shone on it. In the present invention, the nematic is the constituent that can

reorient under the application of an electric field in contrast to Popovich in which the nematic monomer can not react to an electric field.

Further, Popovich describes that both positive and negative dielectric anisotropy nematics exist but the cited reference provides no guidance as to which is better suited for switchable diffraction gratings. In contrast, the Applicant specifies and claims that the positive dielectric anisotropy nematics are employed because only the positive dielectric anisotropy nematics can be used to construct a switchable grating. If a negative dielectric anisotropy nematic were used in the present invention, the gratings would not switch.

Still further, in order for Popovich to achieve high diffraction efficiency in the near IR (*e.g.*, at around 1550 nm), one would be required to use cells with  $> 100 \mu\text{m}$  in thickness. In contrast, the gratings in the present invention operated in the near IR have high contrast and extremely low loss while the cell has a significantly less thickness, around  $< 20 \mu\text{m}$ . This is clearly a result of the PDLC claimed in the present invention that has a very high nematic orientation order.

A further distinction between Popovich and the presently claimed invention is that Popovich's PDLCs do not possess a highly oriented nematic liquid crystal in the voltage-off state. Whereas, the PDLC of the instant invention have extremely high nematic orientational order, where the nematic director is parallel to the grating vector in the voltage-off state. This is evident given that Popovich makes no distinction between grating operation for s- and p-polarization states of light. In the present invention, it is clearly stated that as a result of the high degree of orientational order of the nematic liquid crystal in the PDLC films, the gratings switch only p-polarizes light.

The aforementioned deficiencies found in Popovich are not rectified by Sumiyoshi. According to the Examiner, Sumiyoshi discloses a method of fabricating an electrooptic device comprised of regions of inter-connected spaces that are filled with nematic liquid crystal-rich material. See *Office Action*, pg. 5. The Examiner further argues that it would have been obvious to one skilled in the art to modify the method of

fabricating an electrooptic device of Popovich with the teaching of Sumiyoshi by employing two interfering optical beams which are incident symmetrically about a direction normal to said cell in order to form a PDLC as an unslanted PDLC transmission grating so as to produce a highly bright image. See *Office Action*, pg. 6.

Significantly, however, Sumiyoshi fails the *prima facie* test articulated above, for example, the reference fails to rectify Popovich by not disclosing a nematic LC having a concentration greater than 40% as is claimed in the present invention. This alone defeats Sumiyoshi as a reference for establishing obviousness of the presently claimed invention.

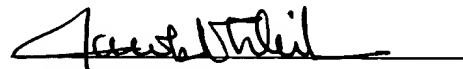
Further, the birefringence claimed in the present invention (due to the high degree of nematic orientational order in the PDLCs of the present invention, specifically recited in claim 13 of the present application) is completely absent in Sumiyoshi. Another feature of the presently claimed invention not disclosed in either Popovich or Sumiyoshi.

Clearly, Sumiyoshi either alone or together with Popovich does not disclose that which is claimed in the present invention. Moreover, there is no suggestion or motivation in either reference to combine and even if they were combined, the result would not be the claimed invention of the present application. Therefore, Applicant respectfully requests reconsideration and withdrawal of the present rejection.

Applicant asserts that the presently claimed invention is in condition of allowance and therefore, respectfully requests that the Examiner issue a Notice of Allowance. The Examiner is invited to call the undersigned attorney at (617) 854-4281 should he determine that a telephonic interview would expedite prosecution of this case.

Respectfully submitted,

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Jacob N. Erlich  
Attorney for Applicant  
Reg. No. 24,338